Ozone as a Disinfectant in Poultry Production

Goals: The purpose of the project is to replace the use of chlorine chemicals with ozone for disinfection in the chiller-bath step in poultry processing. By cleaning the chiller-bath "overflow" rinse water and eliminating the use of chlorine, poultry processors could recycle and reuse up to 80% of the 0.5 gallons per bird of chiller-bath rinse water that presently must be discarded to meet USDA sanitary regulations. By recycling 80% of the 42°F overflow rinse water, poultry processors will be able to achieve significant energy savings. In addition, more effective filtration of the recirculated chilled-bath rinse water should improve the microbiological quality of the product due to improve rinsing and disinfection in the chiller bath .

Technology Path: To demonstrate this new ozone application in food processing, the project will need to secure US Department of Agriculture (USDA) approval for the use of ozone as a replacement for chlorine chemicals for product disinfection in poultry processing operations in California. The USDA will grant such "first of a kind" approval *only* on a facility-specific basis and *only* after pilot testing conducted at the facility conclusively demonstrates that: 1) ozone is an effective anti-microbial disinfection agent in poultry processing that can be safely used in direct contact with the birds; and (2) that ozone does not create any harmful by-products or side affects. Ozone has been declared GRAS (Generally Recognized as Safe) for direct food contact (reference Food Technology, June 1997 and EPRI Technical Report TR-108026-V1,2,& 3, May 1997). Hence, safety of ozone in direct contact with the birds in the chilled water is not expected to be an issue in the project.

Furthermore, before a food producer will convert the water system for a commercial chiller-bath unit to ozone disinfection and closed-loop recycling --- a change that could cost over a million dollars – the producer must be sure that no detrimental affects on product quality (e.g., appearance, taste and shelf life) will occur and that the use of ozone in the proposed process will not create any worker health or safety issues.

Energy Efficiency Benefits:

The project proponents estimate that approximately 3 million kWh per year (net) of electricity can be saved in California by reducing refrigeration loads by adoption of the proposed new closed-loop, chiller-bath water recycling process that will be pilot-tested in this project. This projected energy savings could increase by as much as five time if, as result of new federal Hazard Analysis and Critical Control Points (HACCP) procedures, poultry processors have to increase their chiller-bath overflow rates from 0.5 to 2.5 gallons per bird.

This project supports the PIER program objectives aimed improving energy efficiency in the industrial sector, maximizing market connection, and creating a direct impact on local and state economies.

Technical Objectives:

- Design and pilot-test a prototype system that can be used to replace chlorine with ozone, recover presently wasted chiller-bath overflow water, and more effectively filter and disinfect the recirculated chiller-bath water at commercial poultry processing plants in California.
- Reuse -- instead of discharging -- the 42°F overflow rinse-water stream, after repurifying the water using dissolved air flotation, membrane filtration, and ozonation.
- Use the selected membrane separation process (which may be nanofiltration, ultrafiltration, or microfiltration) to remove most microorganisms and organic material from the recirculated chilled water stream. The retentate from the membrane process (approximately 20% of throughput) may be further refined to collect valuable components before reclaiming the residue with the offal.
- Seek provisional USDA approval to conduct an on-site pilot testing campaign at a commercial processor and accumulate approximately 1,000 hours of operation to measure and document the technical and economic benefits of using ozone.
- Seek final USDA approval for the host facility (Foster Farms' Plant No. 2 in Livingston, California) to use the new process on a full-scale commercial basis.

Economic Objectives:

- Achieve energy savings by returning the filtered and disinfected chiller-bath overflow -water to the heat exchanger used to chill water for the chiller bath. Since the average temperature of the feed water will be reduced to about 50°F from 75°F, the refrigeration load will be dramatically reduced -- which will lower overall system energy requirements. This new process will be able to achieve an estimated net energy savings of 3 million kWh per year of energy (about 12 watts/bird) in the 250-million-bird-per-year poultry processing industry in California.
- This net energy savings is obtained by subtracting the 2 million kWh per year *increase* in energy use for producing ozone and operating the membrane filtration equipment (about 8 watts/bird) from the 5 million kWh per year *decrease* in refrigeration load (about 20 watts/bird) that can achieved by recycling 80% of the chiller-bath overflow rinse water. At a deregulated industrial customer rate of about $0.065 per kWh, the projected industry-wide savings in energy costs as a result of this new process will be about $200,000 per year. These cost savings could increase to over $1,000,000 per year if poultry producers find it necessary to increase their chiller-bath rinse-water makeup requirements form 0.5 to 2.5 gallons per bird to comply with HACCP procedures.
- Achieve cost savings resulting from the reduced volume of wastewater effluent. This savings is estimated at $250,000 per year based on an industry-wide saving 100

million gallons/year (0.4 gallons/bird) in discharged chiller-bath overflow water and wastewater treatment and disposal costs of $2.50 per 1,000 gallons.

- Other potential energy and costs savings will result from the reduced production, shipping, handling and storage of hazardous chlorine chemicals. Although difficult to estimate in advance, the poultry processing industry should be able to achieve cost savings in the range of $100,000 per year by significantly reducing the use of chlorine chemicals.

Principal Investigator:

WaterTech Inc.